Mountains thunder-storms were reported as follows: Ariz., 8th, 17th, 25th, 27th, and 30th; Cal., 1st, 11th, 15th, 23d, 24th, 29th, and 30th; Colo., 1st, 6th, 9th, 10th, 13th, 16th to 19th, 23d, and 26th to 30th; Idaho, 1st, 9th, 11th, 14th, 15th, 17th to 19th, 25th, and 30th; Nev., 16th, 19th, 29th, and 30th; N. Mex., 6th, 8th, 17th, 18th, and 28th to 30th; Oregon, 23d, 30th, and 31st; Utah, 2d to 9th, 20th, and 25th; Wash., 7th, 11th, 16th, 17th, 23d, and 25th; Wyo., 3d, 10th, and 25th to 27th. There were no states or territories west of the Rocky Mountains in which thunder-storms were not reported.

MISCELLANEOUS PHENOMENA.

HALOS.

In the MONTHLY WEATHER REVIEW from January to May, 1890, inclusive, the solar and lunar halos reported in the several sections of the country have been considered in connection with precipitation on the days attending and the second and third days following their occurrence, and also with relation to their occurrence in advance, or following the passage, of storms. This treatment of halos for the period named shows that 73 per cent. of the halos were attended on the first day, 70 per cent. were followed on the second day, and 62 per cent. were followed on the third day by precipitation, and indicates that about three-fourths of the halos noted in the United States were attended on the same day by precipitation at or near the station where they were observed. As regards the percentage of halos which were followed on the second and third days by precipitation in any given district, it is shown that in a large majority of instances halos were also reported for the three consecutive dates. In considering the relations of halos with storms it has been found that in districts lying east of the Rocky Mountains 57 per cent. of the halos occurred in advance, or within the eastern quadrants, of well-defined storms, and that 43 per cent. of the halos were noted in the western quadrants of areas of low pressure or within the limits of areas of high pressure. In the Rocky Mountain and plateau regions less than 50 per cent., and on the Pacific coast less than 20 per cent. of the halos occurred within the influence, or in advance, of storms. As about 75 per cent. of the halos reported were attended on the same day by precipitation at or near the place of observation, and nearly 50 per cent. of the halos occurred after the passage of, and attending, the clearing conditions which follow storms, it will be seen that halos indicate merely a moist condition of the atmosphere, and that they point to a prevalence, or to a strong probability of the occurrence on the same day, of precipitation in the districts where they are observed.

In future issues of the MONTHLY WEATHER REVIEW halos of unusual brilliancy or of a remarkable character only will be noted, and in such cases full descriptions will be given.

DROUGHT.

Drought damaging to crops and vegetation was reported near Charlotte, N. C., Double Springs, Ala., Santa Maria and Mesquite, Tex., Lead Hill, Ark., Howe, Nebr., La Monte and Oak Ridge, Mo., Havensville, Kans., and Lexington, Nebr.

MIRAGE.

At Duluth, Minn., a fine mirage was observed from 11.00 a. m. to 12.30 p. m., 16th. The Wis. shore for 20 to 30 miles stood out in bold relief; forests at an unknown distance appeared inverted; and the mouth of the Brule River, 20 miles distant, was plainly visible.

SUN SPOTS.

Haverford College Observatory, Pa. (observed by Prof. F. P. Leavenworth):

Date.	Number of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Faculæ.	Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	
June, 1890.										
1, 1 p. m...	0	0	0	0	0	0	0	0	1	Definition good.
2, 10 a. m...	0	0	0	0	0	0	0	0	1	Definition good.
3, 10 a. m...	2	5	0	0	0	0	2	5	2	Definition good; spots small.
4, 10 a. m...	1	1	0	0	0	0	1	1	1	Definition good; spots small.
5, 10 a. m...	0	6	0	0	0	0	1	7	1	Definition fair.
6, 10 a. m...	0	4	0	0	0	0	1	11	0	Definition poor.
7, 10 a. m...	0	4	0	0	0	0	1	15	1	Definition good; 1 large spot.
8, 10 a. m...	0	0	0	0	0	0	1	4	1	Definition bad; 1 large spot.
9, 9 a. m...	0	0	0	0	0	0	1	6	1	Definition poor; spots small.
10, 9 a. m...	1	2	0	0	0	0	2	3	1	Definition good.
11, 9 a. m...	0	1	1	1	0	0	1	3	0	Definition fair.
12, 12 m	0	0	0	0	0	0	0	3	1	Definition fair.
13, 10 a. m...	0	0	0	0	0	0	0	0	1	Definition fair.
14, 9 a. m...	1	4	0	0	0	0	1	4	3	Definition good; spots small.
18, 10 a. m...	0	0	0	0	0	0	0	0	1	Definition good.
19, 10 a. m...	0	0	0	0	0	0	0	0	0	Definition fair.
20, 10 a. m...	0	0	0	0	0	0	0	0	0	Definition good.
22, 12 m	0	0	0	0	0	0	0	0	0	Definition poor.
23, 9 a. m...	1	1	0	0	0	0	1	1	1	Definition good.
24, 5 p. m...	0	0	0	0	0	0	0	0	1	Definition good.
25, 10 a. m...	0	0	0	0	0	0	0	0	1	Definition good.
26, 10 a. m...	0	0	0	0	0	0	0	0	1	Definition fair.
27, 10 a. m...	0	0	0	0	0	0	0	0	1	Definition poor.
28, 11 a. m...	0	0	0	0	0	0	0	0	0	Definition fair.
29, 10 a. m...	0	0	0	0	0	0	0	0	2	Definition good.
30, 10 a. m...	0	0	0	0	0	0	0	0	0	Definition fair.

Mr. C. E. Buzzell, Leaf River, Ill.: June 4th and 5th, poor definition; 6th, two small groups near meridian in south latitude, unchanged on 7th, and decreasing on the 8th; 9th and 10th cloudy, clear disc on 11th. None seen on other dates.

Mr. John W. James, Riley, Ill.: observations taken on 1st to 4th, 6th, 7th, 8th, 10th to 13th, 19th, 21st to 30th, or on 22 days of the month, but the only spots seen were: 6th, one group, estimated 31,600 miles long, two days from western edge of the disc; and 7th to 8th, one spot.

Mr. M. A. Veeder, Lyons, N. Y.: 1st, a group of faculæ was about two days advanced from the eastern limb; 5th, spots were seen in the vicinity of this group, and gradually increased in size during the remainder of transit. Faculæ appeared by rotation at the eastern limb, 2d, 5th, 7th, 25th, and 26th. Faculæ were seen at the western limb, 1st and 6th.

H. D. Gowey, North Lewisburgh, Ohio: sun spots were observed on the 7th and 8th.

VERIFICATIONS.

CAUTIONARY SIGNALS FOR JUNE, 1890.

[Verifications made by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams, chief clerk of the Forecast Division.]

Statement showing percentages of justifications of wind signals for the month of June, 1890:

Wind signals.—(Ordered by Assistant Professor H. A. Hazen.) Total number of signals ordered, forty-three; justified as to velocity, wholly, twenty-two, partly, one; justified as to direction, forty-three. Of the signals ordered, thirty-nine were cautionary signals, of which nineteen were wholly justified; and four were storm signals, of which three were wholly, and one partly justified. Twenty-seven signals were ordered for easterly winds, and sixteen for westerly winds, all of which were justified. Percentage of justifications, 59.8.

No cold-wave signals were ordered during the month.

FORECASTS FOR 24 HOURS IN ADVANCE.

The forecasts for districts east of the Rocky Mountains for June, 1890, were made by Assistant Professor H. A. Hazen, and those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps.

Percentages of forecasts verified, June, 1890.

States.		States.	
Maine	68.4	Kentucky	86.1
New Hampshire	76.1	Ohio	82.6
Vermont	79.9	West Virginia	83.9
Massachusetts	76.3	Indiana	80.9
Rhode Island	77.8	Illinois	84.8
Connecticut	74.5	Lower Michigan	79.5
Eastern New York	77.8	Upper Michigan	76.3
Western New York	71.6	Wisconsin	75.9
Eastern Pennsylvania	82.8	Minnesota	72.3
Western Pennsylvania	80.3	Iowa	73.3
New Jersey	78.3	Kansas	79.1
Delaware	80.6	Nebraska	74.7
Maryland	85.4	Missouri	88.1
District of Columbia	84.5	Colorado	86.3
Virginia	84.5	North Dakota	72.7
North Carolina	84.4	South Dakota	79.5
South Carolina	84.3	Southern California*	92.6
Georgia	85.1	Northern California*	88.9
Eastern Florida	85.3	Oregon*	77.8
Western Florida	87.9	Washington*	79.5
Alabama	89.3	*By elements:* Weather	84.6
Mississippi	88.6	Temperature†	75.9
Louisiana	87.6	Monthly percentage of weather and temperature combined‡	81.1
Texas	92.6		
Arkansas	85.7		
Tennessee	82.5		

*In determining the monthly percentage of weather and temperature combined, the Pacific coast states are not included. †The forecasts of temperature in districts east of the Rocky Mountains for June, 1890, were made with reference to the maximum temperature alone; that is, a prediction of warmer or cooler indicated that the maximum temperature of the day designated would be higher or lower than the maximum of the previous day. ‡The monthly percentage of weather and temperature combined is determined by multiplying the percentage of weather by 6, and the percentage of temperature by 4, and dividing their sum by 10.

FORECASTS FOR 48 AND 72 HOURS IN ADVANCE.

Appreciating the great importance that long time predictions possess for the general public the Chief Signal Officer has authorized forecasts for forty-eight and seventy-two hours, covering the second and third days in advance. Such forecasts are optional with the predicting officer, and are only made when clearly in the public interest, and cover, in all cases, considerable areas of country, and are not confined to localities.

Percentages of verifications of forecasts made for second day in advance. Number of predictions made: weather, 43; temperature, 102. Percentages of verifications: weather, 88.8; temperature, 72.2. Weather and temperature combined, 78.6. For third day in advance. Number of predictions made: weather, 6; temperature, 8. Percentages of verifications: weather, 91.7; temperature, 61.2. Weather and temperature combined, 77.4.

Percentages of verifications of weather and temperature signals reported by directors of the various State Weather Services for June, 1890.

States.	Weather.	Temperature.	States.	Weather.	Temperature.
Illinois	78.8	83.2	New Jersey	85.4	91.2
Indiana	78.0	87.0	North and South Dakota	82.0	75.0
Michigan	84.0	86.0	Ohio	80.0	87.0
Minnesota	66.0	67.0	Pennsylvania	86.0	92.0
Missouri	85.0	89.0	South Carolina	77.0	81.4
Nebraska	93.1	85.2			

STATE WEATHER SERVICES.

[*Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.*]

The following extracts and summaries are republished from reports for June, 1890, of the directors of the various state weather services:

ALABAMA.

The month was hot and dry.

Temperature.—Highest monthly mean, 83.3, at Goodwater; lowest monthly mean, 72.8, at Chepultepec; maximum, 99, at Gadsden, 30th; minimum, 50, at Jasper, 5th; greatest local monthly range, 43, at Jasper; least local monthly range, 17, at Chepultepec.

Precipitation.—Greatest monthly, 5.92, at Uniontown; least monthly, 1.46, at Guntersville.

Wind.—Prevailing direction, southeast.—*Prof. P. H. Mell, Auburn, director; J. M. Quarles, Private, Signal Corps, assistant.*

ARKANSAS.

Temperature.—The mean was about 1 above the normal; maximum, 106, at Lead Hill, 26th; minimum, 50, at Newport, 8th; greatest local monthly range, 49, at Lead Hill; least local monthly range, 28, at Conway.

Precipitation.—The average was about 0.26 above the normal; greatest monthly, 9.29, at Little Rock; least monthly, 2.18, at Lead Hill.—*M. F. Locke, Commissioner of Agriculture, Little Rock, director; W. U. Simons, Sergeant, Signal Corps, assistant.*

COLORADO.

Temperature.—The mean was 3 above the average for the past four years; highest monthly mean, 74.5, at Lamar; lowest monthly mean, 43.8, at Leadville; maximum, 103, at Lamar, 22d; minimum, 12, at Breckenridge, 6th; greatest local monthly range, 71, at Breckenridge; least local monthly range, 37, at Cumbres.

Precipitation.—There was about one-half the usual precipitation.

Wind.—Prevailing direction, west.—*Prof. F. H. Loud, Colorado Springs, director; W. S. Miller, Sergeant, Signal Corps, assistant.*

ILLINOIS.

Temperature.—Highest monthly mean, 80.2, at Winnebago; lowest monthly mean, 70.0, at Sandwich; maximum, 104, at East Peoria, 25th, and at Pontiac, 27th; minimum, 40, at Aurora, 8th; greatest local monthly range, 60, at Pontiac; least local monthly range, 38, at Golconda and Pana.

Precipitation—Greatest monthly, 13.57, at Cockrell; least monthly, 2.10, at McLeansborough.

Wind.—Prevailing direction, southwest.—*John Craig, Sergeant, Signal Corps, Springfield, in charge.*

INDIANA.

Temperature.—Highest monthly mean, 82.3, at Huntingburgh; lowest monthly mean, 70.2, at Valparaiso; maximum, 104, at Huntingburgh, 29th, and at Muncie, 23d; minimum, 35, at Point Isabel, 8th; greatest local monthly range, 60, at Point Isabel; least local monthly range, 32, at Shelbyville.

Precipitation.—Greatest monthly, 10.89, at Huntingburgh; least monthly, 2.26, at Mount Vernon.

Wind.—Prevailing direction, southwest.—*Prof. H. A. Huston, La Fayette, director; C. F. R. Wappenhans, Sergeant, Signal Corps, assistant.*

IOWA WEATHER AND CROP SERVICE.

The month was the hottest, and in some localities, the wettest June in Iowa in the last twenty years.

Temperature.—Highest monthly mean, 78.4, at Washington; lowest monthly mean, 67.7, at Iowa City; maximum, 106, at Glenwood, 21st; minimum, 44, at Wesley, 11th; greatest local monthly range, 56, at Glenwood; least local monthly range, 33, at Independence.

Precipitation.—Greatest monthly, 16.53, at Fayette; least monthly, 1.57, at Oskaloosa.

Wind.—Prevailing direction, south.—*J. R. Sage, Des Moines, director; G. M. Chappel, Sergeant, Signal Corps, assistant.*

KANSAS.

Temperature.—The temperature was above the normal in all parts of the state, the average excess being 3.8; highest monthly mean, 86.4, at Ellis; lowest monthly mean, 72.2, near Concordia; maximum, 120, at Collyer, 21st; minimum, 40, at Lakin, 4th and 7th, and at Allison, 9th; greatest local monthly range, 76, at Gibson; least local monthly range, 33, at Salina; greatest daily range, 53, at Lakin, 5th; least daily range, 9, at Leavenworth, 4th.

Precipitation.—There was an excess in Decatur, Norton, Phillips, and Osborne counties, which extended southeastward, culminated in Harvey, and diminished in Sedgwick to Sumner county, where it changed to a deficiency. There was a deficiency of 2.63 in the eastern, and of 2.72 in the western division; greatest monthly, 8.20, at Halstead; least monthly, 0.20, at Gove City.

Wind.—Prevailing direction, south.—*Prof. J. T. Lovewell, Topeka, director; T. B. Jennings, Sergeant, Signal Corps, assistant.*

KENTUCKY.

Temperature.—The mean was about 4 above the normal; maximum, 101, at Murray, 26th and 29th; minimum, 51, at Pellville, 8th; greatest monthly range, 49, at Murray and Pellville; least monthly range, 29, at South Fork.

Precipitation.—The average was slightly in excess of the normal; greatest monthly, 9.66, at Shelbyville; least monthly, 1.20, at Canton.

Wind.—Prevailing direction, southwest.—*Dr. E. A. Grant, Louisville, director; Frank Burke, Sergeant, Signal Corps, assistant.*